# Directing Time: The Effect of Timeline Orientation and Direction on Causation in Litigation Law

## Problem

In litigation law, lawyers must describe a sequence of events to judge and jury while making a persuasive argument as to the cause of an alleged wrongdoing. Temporal sequence – the order of events – is the most basic requirement for causation. Increasingly, lawyers are turning to graphical representations in the courtroom, such as animated PowerPoint presentations, to support their arguments. This study aims to investigate the possible influence of the orientation and direction of a visual timeline depicting a sequence of events on the memory, comprehension and decision making of jurors.

## Conceptual Framework

Humans exhibit remarkable flexibility in the way we conceptualize time (Núñez & Cooperrider, 2013). Empirical evidence suggests that a number of metaphors for temporal experience prevalent in language are reflected in spatial representations, even during non-linguistic tasks (Fuhrman & Boroditsky, 2010). For temporal order, timelines are the most commonly used visual-spatial representations. While there is no predominant spatial metaphor for temporal order in the English language, we do have a number of cultural artifacts that are believed to influence our spatial conceptualization of event sequence. On 2-dimensional surfaces, calendars and agendas are most prevalent, with information flowing from left to right and top to bottom, consistent with the direction and orientation of written language (Núñez & Cooperrider, 2013).

According to Philip Johnson-Laird's mental model theory of reasoning, humans create small-scale models of the world, consisting of mental images and complex abstract structures (Johnson-Laird, 1999). Importantly, mental models represent what is true, or what is possible, and not what is false. Humans construct models based on perception and information processing, and inspect them in order to perform complex cognitive operations such as decision-making. While researching the flexible foundations of human abstract thought, Julio Santiago has suggested that the choice of a spatial conceptualization of time in any one situation is a result of importing the most relevant mental model into working memory, depending on the contents of the model and task demands (Santiago, Román, & Ouellet, 2011). This proposition seeks to explain the flexibility with which humans can alternate between and adopt new spatial representations of time, and other abstract concepts. Santiago argues that a 'coherence mechanism' prevents inconsistent mental models from being reconstructed in working memory at the same time.

Drawing on theories of conceptual metaphor to account for the nature of abstract thought, the theory of mental models to account for human reasoning, and Santiago's flexible foundations theory of metaphoric reasoning, this study seeks to investigate the degree of flexibility of spatial construals of temporal order.

## Operational Definitions

- A **timeline** is a 2-D visual-spatial representation of a sequence of events.
- **Spatial Construal of Time** (SCT) refers to the visual-spatial presentation of a component of time. For temporal sequence, a 2D SCT contains an orientation (axis) and direction.
- A timeline is **consistent** if it is presented in the same orientation (axis) and direction (flow of time) as the viewer's written language. (E.g. For native English speakers, a consistent timeline would unfold from left to right along a horizontal axis.)
- A timeline is **inconsistent** if it is presented using a differing orientation. (E.g. For native English speakers, an inconsistent timeline would unfold in any direction along a vertical axis.)
- A timeline is **contradictory** if it is presented using the same orientation, but opposing direction as the viewer's written language. (E.g. For native English speakers, a contradictory timeline would unfold from right to left along a horizontal axis.)

**Hypothesis**

The presentation of inconsistent or contradictory timelines impairs the development of a coherent mental model for a sequence of events. As a consequence, Ss will have decreased memory for the details and order of presented events, and therefore be more likely to make errors in determining causation. In a mock-trial scenario, Ss will have less confidence in their decision of culpability.

*When compared with a control group (consistent timeline), Ss presented with inconsistent (A) and contradictory (B) timelines will...*

H1: remember fewer details of the case
H2: remember the case less accurately
H3: be less likely to decide the defendant is culpable
H4: have less confidence in their decision
E1: After a brief delay, Ss choice of spatial construal (SCT) will return to neutral condition.
*H0: no significant differences in decision of culpability or memory of case will be found*

**Participants**

(200?) undergraduates from CSU-Chico.

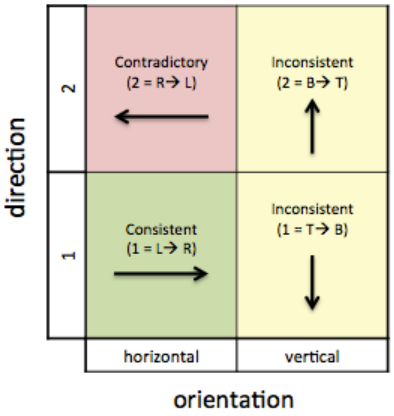
**Procedure**

| STEP | | INSTRUMENT | VALUES |
|---|---|---|---|
| 1 | Measure $SCT_p$<br>(Control Variable)* | [custom]<br>timeline construction task | Consistent = Horizontal (L → R)<br>Contradictory = Horizontal (R →L)<br>Inconsistent = Vertical (T→B)<br>Inconsistent= Vertical (B→T) |
| 2 | Present stimuli<br>(Manipulate IV $SCT_s$) | Subject listens/watches multimedia video presentation. Ss are wearing headphones, unable to pause, rewind or fast forward. | |
| 3 | Present stimuli<br>(Filler Task) | Subjects are presented with photographs and audio recordings of evidence (adds additional load to memory, not relevant to causation) | |
| 4 | Measure Memory<br>(DV Memory-Depth)<br>(DV Memory-Accuracy) | Recall + Recognition Task<br>[talk about strategy] ( Ss recall, then recognize details from the case) | Quantity (# of idea units)<br>Accuracy (% correct units) |
| 5 | Measure Memory<br>(DV Memory – Order)<br>(DV $SCT_2$) | Reconstruction Task<br>Ss reconstruct the sequence of events based on the units identified in step 4 | Accuracy (sequence analysis)<br><br>Consistent = 1-Horizontal (L → R)<br>Contradictory = 2-Horizontal (R →L)<br>Inconsistent = 1-Vertical (T→B)<br>Inconsistent= 2-Vertical (B→T) |
| 6 | Measure Culpability<br>(DV Decision)<br>(DV Confidence) | Likert-Scale | -3 -2 -1 0 1 2 3 |

*Ss who do not select an $SCT_p$ = 1 Horizontal (L → R) will be excluded from analysis.

**Design – Experiment 1: One Information Source**

The first experiment will examine influence of timeline orientation and direction on memory and causal reasoning by presenting subjects with one narrative of a sequence of events.
2 (orientation: horizontal vs. vertical) X 2 (direction: same as writing vs. opposite to writing) design, yielding four experimental conditions



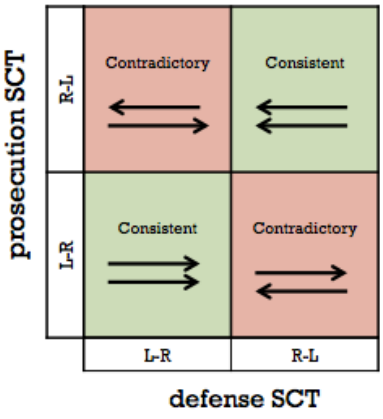

Factor 1: orientation;
Levels: horizontal, vertical
Factor 2: direction;
Levels: 1[as writing direction], 2 [opposing writing direction]

CV: *a priori* SCT (= horizontal L/R)
IV: presentation SCT
DV: memory (recall + recognition)
causal reasoning
reconstruction SCT

*I expect that subjects will overcome the information processing demands of an inconsistent/contradictory timeline presentation from one source with relative ease. I expect that memory and reasoning scores will be highest for the consistent condition, lowest for contradictory condition, and in-between for the two inconsistent conditions. I expect that the reconstruction SCT will match the presentation SCT.*

**Design – Experiment 2: Two Information Sources**

The second experiment will further examine the influence of timeline orientation and direction on memory and causal reasoning, further challenging subjects by asking them to integrate information from two sources narrating a sequence of events.
2 (prosecution SCT: L->R vs. R->L) X 2 (defense SCT: L->R vs. R->L ) yielding four conditions




Factor 1: Direction of stimulus for prosecution
Levels: L-R, R-L
Factor 2: Direction of stimulus for defense
Levels: L-R, R-L

CV: *a priori* SCT (= horizontal L/R)
IV: prosecution SCT
defense SCT
DV: memory (recall + recognition)
decision-making
confidence
reconstruction SCT

*I expect that subjects will have more difficulty with the information processing demands of integrating contradictory visualizations of the timeline from two narrative sources. I expect that memory and reasoning scores will be highest for the first consistent condition (L-R), lowest for contradictory conditions, and in-between for the last consistent condition (R-L). I expect that the reconstruction SCT will match the presentation SCT for consistent conditions, and the a priori SCT for contradictory conditions.*

**Relevant Literature**

***The Human Experience of Time***

(1) Time is an abstract concept, for which we have (thus far) found no dedicated sensory organ (Block, 1990; Hancock & Block, 2012). *This study will focus on the conceptualization rather than perception of time.*

(2) Our experience of time comprises such subjective phenomena as: simultaneity, successiveness, temporal order, subjective present, temporal continuity and subjective duration (Pöppel, 1997). *We will focus on temporal order.*

(3) "Positions in time" [temporal order] can be conceived in two ways: as a relation between two events (earlier/later; B-series; sequential) or as a relation between three events (past/present/future; A-series; deictic) (McTaggart, 1908). *The experimental materials will control for a consistent representation of relations (likely B-series/sequential).*

(4) Time can be conceived from an internal (egocentric) or external (allocentric) point of view of the observer (Núñez & Cooperrider, 2013). *The experimental materials will control for a consistent representation of perspective (external/allocentric).*

***Thinking about time – Conceptual Metaphor***

(5) In language, we employ a number of metaphors to express ideas about time (Lakoff & Johnson, 1980).

(6) Abstract domains (such as time) are structured through metaphorical mappings from domains grounded directly in physical experience (such as space) (Boroditsky, 2000).

~~(7) According to the *Metaphoric Structuring View*, aspects of time that are relevant to space will be shaped by the metaphors utilized. The *weak view of metaphoric structuring* posits that, with frequent use, spatial metaphors become established in the representation of the domain of time, so spatial schemas may no longer be accessed when thinking about time (Boroditsky, 2000).~~

~~(8) Empirical evidence suggests that spatial primes of movement metaphors can effectively influence how individuals think about time (Boroditsky, 2000).~~

(9) Empirical evidence suggests that individuals automatically recruit "culturally suggested" representations of time, even when performing non-linguistic tasks (card sort, early/later judgments of pictures) (Fuhrman & Boroditsky, 2010).

(10) Humans use *mental metaphors* that may correspond to linguistic metaphors, in order to conceptualize abstract domains, even when not using language (Casasanto, 2010).

***Conceptual flexibility***

(11) Culturally suggested spatial representations of time are the product of: linguistic metaphors, writing direction, and cultural artifacts (Núñez & Cooperrider, 2013).

(12) Temporal metaphors show an impressive degree of flexibility within and across individuals, languages and cultures (Santiago et al., 2011).

(13) There is a dearth of linguistic metaphors for directionality of time; however, there are metaphors in cultural artifacts, including reading direction, calendars, and the typical layout of graphs (Santiago et al., 2011).

(14) New conceptual metaphors can be acquired at an impressive speed (Santiago et al., 2011).

(15) Some of the factors that mediate the manifestation of one or another conceptual mapping are: the relevance of an attended supporting context (priming), habitual exposure, use of linguistic expressions, and graphic cultural conventions (Santiago et al., 2011).

***Visualization in the Law***

(Johnson-Laird, 1999)
(Feigenson, 2010), (Park & Feigenson, 2013)
(Galves, 2000)

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